Modern Methods for Study and Evaluation in Maritime Universities According to MET Requirements

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Abstract: - Any maritime university has to comply with the requests imposed by the Ministry of Education which in most countries co-ordinates and guarantees the quality of education. On the other hand, the maritime university has to act according to the requests of the International Maritime Organization (IMO), within the so-called Maritime Education and Training concept – MET. It results the main characteristic of a maritime university: to comply at the same time with the requirements of the national educational system and those of the International Maritime Organization. The maritime universities ensure a complex education and training due to the demand for maritime personnel, qualified both "off-shore" and "on-shore" and to the more and more complex technology on board ships. The status of maritime university depends on the way they will organize the educational and research process and on the way they will succeed in fulfilling the needs of present time. That means mainly courses, laboratories and evaluation. The paper presents the efforts made in our university to develop and implement advanced distant simulation technology (on board and ashore) and formal teaching or training in the classroom or in the simulator respectively (ashore). Also it analyses the modern methods for better evaluation of the students.

Key-Words: - MET, Distance learning, Web Based Course, Simulation complex, Multiple Choice Test,

off-shore.

1 Introduction

The maritime universities must to ensure a complex education and training – that means to comply with the requests imposed by the Ministry of Education and the requests of the International Maritime Organization, within the so-called Maritime Education and Training concept – MET.

On the other hand, the maritime universities have to act according to advanced learning technologies, especially advanced and innovative educational software.

International Maritime Organization (IMO) recommends using modern methods for study and evaluation in MET.

Advanced distant learning represents one of these modern methods. All merchant marine officers and ratings must periodically attend continuous training courses in various fields (safety, preventing pollution, security). They also must attend specialized courses for specialized ships: tankers (oil, chemical, gas), containers, etc. These courses are provided by training centers or maritime universities and require a long period of time for sailors. A modern solution can be distant learning.

Is distant learning appropriate for maritime education? I will try to explain in the paper.

Other modern method recommended by IMO is simulation. The paper focuses on ANSYS FLUENT, a CFD programme based on finite volume calculation. The programme is use on courses to illustrate fluid properties and some important phenomena in hydrodynamics. The students can make a comparison between the results obtained in the laboratory and the results of simulation. I will emphasize the possibility to use the programme for research.

Modern teaching tools must be followed by modern assessment methods. The multiple choice

test has been extended in MET. This method provide for a fast and accurate evaluation by means of modern computation facilities

2 MET Requirements

A syllabus to comply with the requirements of an international body, IMO respectively, is the main specific aspects of maritime higher-education. Applicants' selection, compulsory on-board training, external acknowledgement of the university performed by the national naval authority, double certification: officer and engineer are the others. Maritime Education and Training (MET) states in IMO Convention on International Standards for Training, Certification and Watch keeping for Seafarers (STCW 78/95) is a common element of maritime curricula worldwide.

There are diverse approaches of curricula among maritime universities in different countries. In West European countries the academic MET focuses on transport and has a limited scientific content, while in east European countries, the academic MET is mostly focused on engineering, having a substantial scientific content [5]. In Romania there are important similarities with the syllabi of technical universities.

The METNET programme of the European Union has developed the following concept of 4E:
Essentials, programmes satisfying minimal requests of STCW;
Extension, improvement of STCW programmes and including others that are not linked to STCW, but which are limited to the ship;
Enrichment, programmes dedicated to employment in other on shore maritime activities;
Elevation, improvement of 3E and post university studies.

The maritime universities ensure a complex education and training due to the demand for maritime personnel, qualified both „off-shore" and „on-shore" and to the more and more complex technology on board ships [1]. Also a university diploma allows a maritime officer to attend post-university studies, i.e. master's and even doctoral degrees.

The status of maritime university depends on the way they will organize the educational and research process and on the way they will know to fulfil the needs of present time. That means mainly courses, laboratories and evaluation.

3 WEB based courses

Constanta Maritime University (CMU) has joined an important EU project for distant simulation and tutorial systems on board. The project, under the Leonardo da Vinci program, refers to the IMO Tanker Courses, the cooperation partners being: University of Bremen, Germany; Kongsberg Maritime, Norway; Elsfleth Maritime University, Oldenburg, Germany; Constanta Maritime University, Romania, Escola Nautica Infante D. Henrique, Portugal and also seven tanker companies in Europe.

The courses, written according to the regulation of Standards of Training, Watchkeeping and Certification (STCW) Code, consists of several modules which can be studied independently based on the tanker experience of the participants (Fig. 1). Our tutorial system (Learning Management System – LMS) is based on ILIAS, an open source web-based learning management system, generally adopted by universities [3].

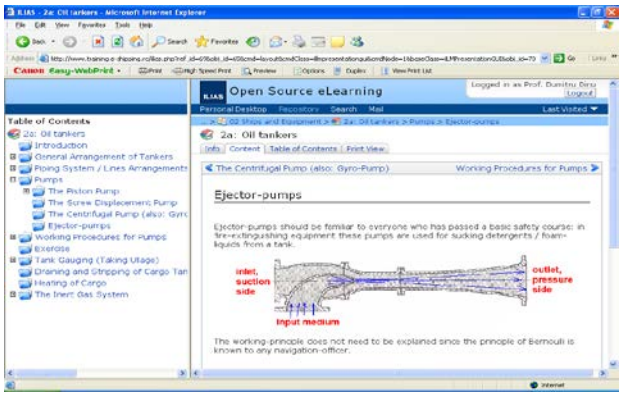

Fig. 1 Course on line

In addition to the theory modules you will find tests and simulation exercises – video demonstration (Fig. 2). The exercises and the models are similar to those used in the Liquid Cargo Handling Simulation in Constanta Maritime University, the place of theoretical and practical examination.

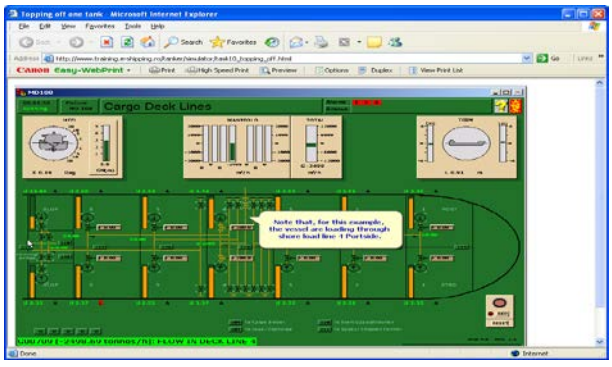

Fig. 2 Simulation exercise

4. Simulation laboratory

There are many simulators in our maritime university: Engine Room Simulator, Bridge Simulator, Dynamic Positioning Simulator, etc. Simulation is a modern learning method recommended by IMO. I will discuss about simulation using Computational Fluid Dynamics (CFD), ANSYS FLUENT respectively, which solves the Navier-Stokes equations for different cases.

This programme is used for learning, to illustrate fluid properties and some important phenomena in hydrodynamics: Bernoulli's equations for the relative movement of ideal non-compressible fluid, hydrostatic forces, flow with and without circulation around profiles, velocity distribution in circular conduits, forces on the hydrodynamic profiles, induced resistances in the case of finite span wings, boundary layer, etc. But not only.

We can compare the results obtained in the laboratory and the results of CFD. The calculation of a hydrodynamic profile for a fluid that flows around it, mainly consists in determining the variation of drag force and bearing force, whose values vary with the shape profile, wing span, incident angle and type of flow (Reynolds number). We calculated and compared the changes of coefficient force values mentioned above for finite span wings (large-span and small-span). The calculation will be done both experimentally in a wind tunnel, which will allow us to change the incidence angle and speed of fluid (and hence the Reynolds number), and with a computational fluid dynamics – CFD (Fig. 3 and Fig. 4)[4].

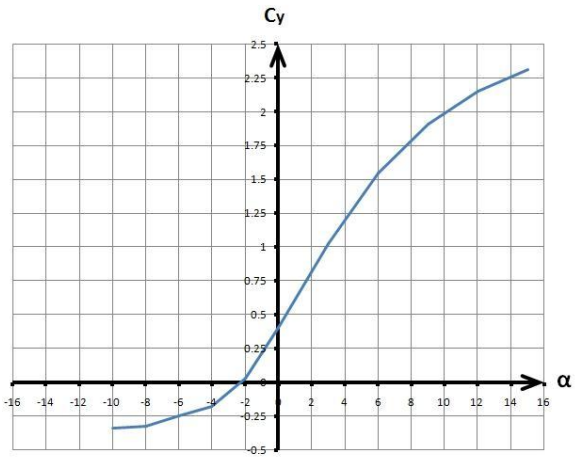

Fig. 3 Graphic of C_y experimentally obtained

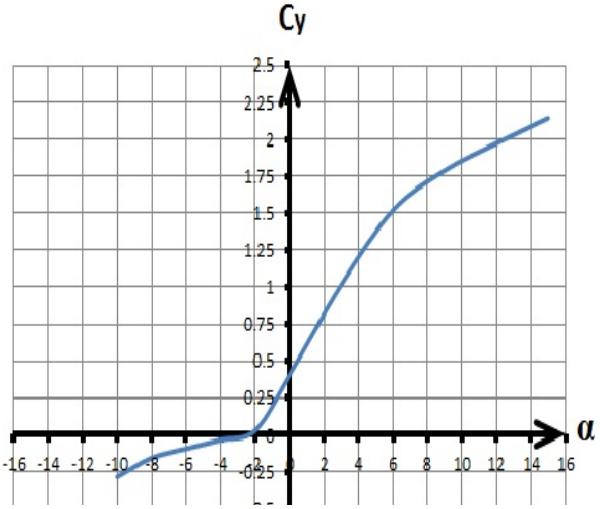

Fig. 4 Graphic of C_y obtained using CFD

We want to emphasize the possibility to use CFD for research. We have simulated an unconventional naval propulsion system – kite. This is used as auxiliary propulsion system. This simulation, performed with CFD (Computer Fluid Dynamics), was made for different working conditions by varying the incidence angle and the velocity at infinity. We also calculated total aerodynamic force, which projected on the water surface, gives us the force by which the ship is being towed (the component of the ship direction movement). Having calculated all the force values we have introduced them in the bridge simulator for different scenarios. We used two simulators to study the influence of kite propulsion on ship's course stability.

It is difficult to achieve a model for experimenting. Also it is difficult to calculate the phenomena in the nature scale using the FLUENT. So we calculated the physical parameters, using FLUENT on the model and we pass them, using the similitude criteria, in the nature. The results obtained are very close to the nature. The main idea is that FLUENT can be used as an experimental stand.

Some problems, especially related to the long objects (conduit, brake waters, etc.) can be solved using two geometrical scales (one for length and one, smaller, for diameter). By applying the formulas for distortional similitude, we can pass from the model to the nature.

5. Evaluation

There are many testing procedures: multiple choise test only, combination of multiple choice and classic tests, multiple choice tests together with oral exams or practical works, etc. Computer tests can be made in large numbers, each student having a different test.

A modern method is the online test. Online testing center can provide a special organizational frame for complex testing, having a higher degree of safety (on time password, watching the student tested at a distance).

Below is presented the synoptic diagram of online testing system which is structured on two levels: the instructor administrator level (Core Program Level) and the one of the tested students (Students Level) [2]. The connection between these two levels is performed by distributed networks (Internet) (Fig. 5).

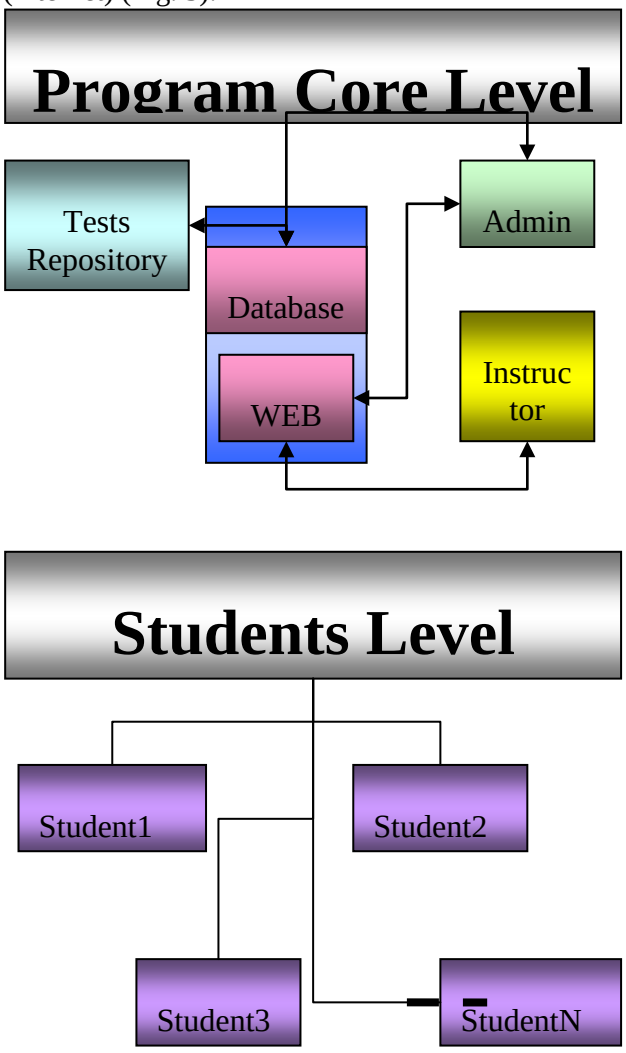

Fig. 5 Synoptic diagram of online testing system

Computer and online testing use multiple choice tests. Characteristics of this kind of test: only one (quite simple) or more correct answer (difficult); number of choices could be 2,3,4 or more; statement type, question type which has a positive or negative answer .

It is advisable that the test be realistic, linked with specific aspects of the students' future job. For students in Maritime Universities I will give a relevant example of this last characteristic [2]:

Let: A – the set of maritime officers; B – the set of ships these officers are on ; C – the set of captains from set A.

Defining functions:

$f_1 : A \to B;\ f_1(a) =$ *the ship officer a is on;*

$f_2 : B \to A;\ f_2(b) =$ *the officer who is the capitain of ship b;*

$f_3 : B \to C;\ f_3(b) =$ *the capitain of ship b;*

$f_4 : A \to C;\ f_4(a) =$ *the capitain of the ship officer a is on.*

Wich of the above functions is bijective?

a) f_1; *b)* f_2; *c)* f_3; *d)* f_4; *e)none.*

A - c

6 Conclusion

The advantage of WEB based courses is the reduction of contact hours in maritime training and education (free training and education capacity on shore to serve the growing need for nautical officers in the coming years). Also, harmonization of maritime education in Europe (common standards, methods and a network for knowledge cooperation) could be an important advantage.

In Introduction we put the question: *Is distant learning appropriate for maritime education?* The answer is: Yes, in certain stages of this education and combined with the other education forms [3].

All the simulation programmes used in maritime universities are appropriate to illustrate important

phenomena in shipping. But CFD programme is more. Comparing results obtained in laboratories with CFD calculation allow us to better understanding physical process and the source of errors (experimental errors - errors of measurement devices, numerical errors - rounding errors, and also discretization errors). For master and Ph.D. students CFD is used for research. Very interesting is to combine CFD with Bridge Simulator to study the influence of kite propulsion on ship's course stability. Is a new possibility to make use of simulators capabilities for research.

Regarding Multiple Choice Test Evaluation we can conclude that these tests can eliminate the possibility of random choice. A correct elaboration can assess the degree of understanding. In MET it is more important to read and understand diagrams and schemes – which multiple choice tests allow – than their reproduction. The concision is an important advantage. It is necessary to emphasis the following disadvantages [2]: haphazard choice of the right answer; the chance for intelligent but not well prepared students to guess the answer; rote learning of the right answers.

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